

IN THE CLAIMS:

In accordance with the following, no claims have been amended, cancelled, or added and are only being presented for the convenience of the Examiner.

1. (CANCELED)

2. (PREVIOUSLY PRESENTED) An electrolyte for a lithium-sulfur battery having a positive and negative electrode, comprising:

a first solvent having a dielectric constant that is greater than or equal to 20;

a second solvent having a viscosity that is less than or equal to 1.3 cP; and

an electrolyte salt,

wherein:

 said first solvent is at least one selected from a group consisting of methanol, hexamethyl phosphoramide, ethanol, and isopropanol, and

 the first solvent is roughly between 20% and 80% by volume of the electrolyte.

3. (WITHDRAWN) The electrolyte for the lithium-sulfur battery of claim 2, wherein said second solvent is at least one selected from a group consisting of methylethyl ketone, pyridine, methyl formate, n-propyl acetate, ethyl ether, methylethyl carbonate, toluene, fluorotoluene, benzene, fluorobenzene, p-dioxane, and cyclohexane.

4. (PREVIOUSLY PRESENTED) A lithium-sulfur battery comprising:

a positive electrode including an active material including lithium;

a negative electrode having another active material including sulfur; and

an electrolyte disposed between the positive and negative electrodes, the electrolyte comprising:

 a first solvent having a dielectric constant that is greater than or equal to 20;

 a second solvent having a viscosity that is less than or equal to 1.3 cP; and

 an electrolyte salt,

wherein:

 the first solvent is between 20% inclusively and 30% by volume of the electrolyte, and

 the second solvent is roughly between 80% and about 60% by volume of the electrolyte.

5. (WITHDRAWN) The lithium-sulfur battery of claim 4, wherein the electrolyte further comprises an additive that forms a solid electrolyte interface (SEI) at a surface of the

negative electrode during charging.

6. (WITHDRAWN) The lithium-sulfur battery of claim 5, wherein said additive is at least one selected from a group consisting of vinylene carbonate, vinylene trithiocarbonate, ethylene trithiocarbonate, ethylene sulfite, ethylene sulfide and bismuth carbonate.

7. (WITHDRAWN) The lithium-sulfur battery of claim 5, wherein said additive is roughly between 0.2% and 10% by weight of the electrolyte.

8. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 4, wherein said electrolyte salt is at least one selected from a group consisting of lithium hexafluorophosphate (LiPF_6), lithium tetrafluoroborate (LiBF_4), lithium hexafluoroarsenate (LiAsF_6), lithium perchlorate (LiClO_4), lithium trifluoromethane sulfonyl imide ($\text{LiN}(\text{CF}_3\text{SO}_2)_2$), and lithium trifluorosulfonate ($\text{CF}_3\text{SO}_3\text{Li}$).

9. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 4, wherein a concentration of said electrolyte salt is roughly between 0.5 M and 2.0 M.

10. (PREVIOUSLY PRESENTED) A lithium-sulfur battery comprising:
a negative electrode comprising a negative active material selected from a group consisting of lithium metal, lithium-containing alloy, a combination electrode of a lithium/inactive sulfur, a compound that can reversibly intercalate lithium ion, and a compound that can reversibly redioxide with a lithium ion at a surface;

an electrolyte comprising a first solvent having a dielectric constant that is greater than or equal to 20, a second solvent having a viscosity that is less than or equal to 1.3 cP, and an electrolyte salt; and

a positive electrode comprising a positive active material comprising at least one sulfur-based material selected from a group consisting of a sulfur element, Li_2S_n ($n \geq 1$), an organic sulfur compound, and a carbon-sulfur polymer ($(\text{C}_2\text{S}_x)_n$ where $x=2.5$ to 50 and $n \geq 2$), and an electrically conductive material,

wherein

the first solvent is roughly between 20% and 40% by volume of the electrolyte,
and

the second solvent is roughly between 80% and about 60% by volume of the electrolyte.

11. (PREVIOUSLY PRESENTED) A lithium-sulfur battery comprising:
a positive electrode including an active material including lithium;
a negative electrode including another active material including sulfur; and
an electrolyte disposed between the positive and negative electrodes, the electrolyte
comprising

a first solvent having a polarity high enough to dissolve an ionic compound;
a second solvent having a viscosity that is less than or equal to 1.3 cP; and
an electrolyte salt,

wherein

the first solvent is between 20% inclusively and 30% by volume of the electrolyte,
and

the second solvent is roughly between 80% and about 60% by volume of the
electrolyte.

12. (PREVIOUSLY PRESENTED) A lithium-sulfur battery comprising:
a negative electrode comprising a negative active material including sulfur;
an electrolyte comprising

a first solvent having a polarity high enough to dissolve an ionic compound,
a second solvent having a viscosity that is less than or equal to 1.3 cP, and
an electrolyte salt; and

a positive electrode comprising a positive active material including lithium,

wherein

the first solvent is roughly between 20% and 40% by volume of the electrolyte,
and

the second solvent is between 70% and 80% inclusively by volume of the
electrolyte.

13. (ORIGINAL) The lithium-sulfur battery of claim 12, wherein the first solvent has a
dielectric constant that is greater than or equal to 20.

14. (PREVIOUSLY PRESENTED) A lithium-sulfur battery comprising:
a negative electrode comprising a negative active material;
an electrolyte comprising

a first solvent having a polarity high enough to dissolve an ionic compound,
a second solvent having a viscosity that is less than or equal to 1.3 cP, and

an electrolyte salt; and

a positive electrode comprising a positive active material,

wherein:

the first solvent is at least one selected from a group consisting of methanol, hexamethyl phosphoramide, ethanol, and isopropanol,

the first solvent is roughly between 20% and 80% by volume of said electrolyte,

and

the second solvent is roughly between 20% and about 80% by volume of said electrolyte.

15. (WITHDRAWN) The lithium-sulfur battery of claim 14, wherein the second solvent is at least one selected from a group consisting of methylethyl ketone, pyridine, methyl formate, n-propyl acetate, ethyl ether, methylethyl carbonate, toluene, fluorotoluene, benzene, fluorobenzene, p-dioxane, and cyclohexane.

16. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 14, wherein:

the first solvent is roughly between 20% and 40% by volume of said electrolyte, and

the second solvent is roughly between 80% and about 60% by volume of said electrolyte.

17. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 14, wherein a ratio of the first solvent to the second solvent is roughly 1:1.

18. (WITHDRAWN) The lithium-sulfur battery of claim 12, wherein said electrolyte further comprises an additive that prevents the formation of dendrite on a surface of said negative electrode during charging.

19. (WITHDRAWN) The lithium-sulfur battery of claim 18, wherein the additive forms a solid electrolyte interface (SEI) at the surface of said negative electrode.

20. (WITHDRAWN) The lithium-sulfur battery of claim 18, wherein the additive is at least one selected from a group consisting of vinylene carbonate, vinylene trithiocarbonate, ethylene trithiocarbonate, ethylene sulfite, ethylene sulfide and bismuth carbonate.

21. (WITHDRAWN) The lithium-sulfur battery of claim 18, wherein the additive is roughly between 0.2% and 10% by weight of said electrolyte.

22. (WITHDRAWN) The lithium-sulfur battery of claim 10, further comprising an additive that forms a solid electrolyte interface (SEI) at a surface of the negative electrode during charging.

23. (WITHDRAWN) The lithium-sulfur battery of claim 22, wherein said additive is at least one selected from a group consisting of vinylene carbonate, vinylene trithiocarbonate, ethylene trithiocarbonate, ethylene sulfite, ethylene sulfide and bismuth carbonate.

24. (WITHDRAWN) The lithium-sulfur battery of claim 23, wherein said electrolyte salt is at least one selected from a group consisting of lithium hexafluorophosphate (LiPF₆), lithium tetrafluoroborate (LiBF₄), lithium hexafluoroarsenate (LiAsF₆), lithium perchlorate (LiClO₄), lithium trifluoromethane sulfonyl imide (LiN(CF₃SO₂)₂), and lithium trifluorosulfonate (CF₃SO₃Li).

25. (WITHDRAWN) The electrolyte for the lithium-sulfur battery of claim 3, wherein said first solvent is sulfolane, and said second solvent is the toluene.

26. (WITHDRAWN) The electrolyte for the lithium-sulfur battery of claim 3, wherein said first solvent is sulfolane, and said second solvent is the n-propyl acetate.

27. (WITHDRAWN) The lithium-sulfur battery of claim 15, wherein said first solvent is sulfolane, and said second solvent is the toluene.

28. (WITHDRAWN) The lithium-sulfur battery of claim 15, wherein said first solvent is sulfolane, and said second solvent is the n-propyl acetate.

29. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 4, wherein the first solvent is at least one selected from a group consisting of ethylene carbonate, propylene carbonate, dimethyl sulfoxide, sulfolane, γ -butyrolactone, acetonitrile, dimethyl formamide, methanol, hexamethyl phosphoramide, ethanol, and isopropanol.

30. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 4, wherein the second solvent is at least one selected from a group consisting of methylethyl ketone, pyridine, methyl formate, tetrahydrofuran, diglyme (2-methoxyethyl ether), 1,3-dioxolane, methyl acetate, 2-methyl tetrahydrofuran, ethyl acetate, n-propyl acetate, ethyl propionate, methyl propionate, ethyl ether, diethyl carbonate, methylethyl carbonate, dimethyl carbonate, toluene, fluorotoluene, 1,2-dimethoxy ethane, benzene, fluorobenzene, p-dioxane, and cyclohexane.

31. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 10, wherein said first solvent is at least one selected from a group consisting of methanol, hexamethyl phosphoramide, ethanol, and isopropanol.

32. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 10, wherein the second solvent is between 70% and 80% inclusively by volume of the electrolyte.

33. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 10, wherein the first solvent is between 20% inclusively and 30% by volume of the electrolyte.

34. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 10, wherein the second solvent is substantially 80% by volume of the electrolyte.

35. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 10, wherein the first solvent is substantially 20% by volume of the electrolyte.

36. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 14, wherein the second solvent is between 70% and 80% inclusively by volume of the electrolyte.

37. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 14, wherein the first solvent is between 20% inclusively and 30% by volume of the electrolyte.

38. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 14, wherein the second solvent is substantially 80% by volume of the electrolyte.

39. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 14, wherein the first solvent is substantially 20% by volume of the electrolyte.

40. (PREVIOUSLY PRESENTED) The lithium-sulfur battery of claim 14, wherein said first solvent is at least one selected from a group consisting of methanol, hexamethyl phosphoramide, ethanol, and isopropanol.

41-42. (CANCELLED)